

WHAT IS CLAIMED IS:

1. A compact chemical reactor comprising:

a first substrate;

a second substrate attached to the first

5 substrate;

a micro flow path defined between the first substrate and the second substrate; and

a thin film heater provided in the flow path.

2. The compact chemical reactor according to

10 claim 1, wherein

the flow path is defined by a groove provided in the first substrate and by a surface of the second substrate opposite to the groove; and

the thin film heater is provided on the opposite 15 surface of the second substrate.

3. The compact chemical reactor according to claim 1, further comprising a catalyst layer provided in the flow path.

4. The compact chemical reactor according to 20 claim 1, wherein

the flow path is defined by a groove provided in the first substrate and by a surface of the second substrate opposite to the groove;

the thin film heater is provided on the opposite 25 surface of the second substrate; and

the catalyst layer is provided on a surface of the first substrate.

5. The compact chemical reactor according to  
claim 1, wherein

the flow path is defined by a groove provided in  
the first substrate and by a surface of the second  
substrate opposite to the groove;

5 the thin film heater is provided in the opposite  
surface of the second substrate; and

the catalyst layer is provided on a surface of the  
thin film heater.

10 6. The compact chemical reactor according to  
claim 1, wherein

the flow path is defined by a groove provided in  
the first substrate and by a surface of the second  
substrate opposite to the groove;

15 the thin film heater is provided on the opposite  
surface of the second substrate;

a first catalyst layer is provided on a surface of  
the thin film heater; and

20 a second catalyst layer is provided on a surface  
of the groove of the first substrate.

7. The compact chemical reactor according to  
claim 1, wherein

the flow path is defined by a first groove  
provided in the first substrate and by a second groove  
25 provided in the surface of the second substrate  
opposite to the second groove;

the thin film heater is provided on the second

groove of the second substrate or the first groove of the first substrate; and

a catalyst layer is provided on the second groove of the second substrate or the first groove of the  
5 first substrate.

8. The compact chemical reactor according to claim 1, wherein

the flow path is defined by a first groove provided in the first substrate and by a second groove provided in the surface of the second substrate  
10 opposite to the groove; and

the thin film heater is provided on the groove of the first substrate or the second substrate.

9. The compact chemical reactor according to  
15 claim 1, wherein a catalyst layer is provided on the surface of the thin film heater.

10. The compact chemical reactor according to claim 1, wherein the first substrate has a material having a thermal conductivity different from the  
20 thermal conductivity of the second substrate.

11. The compact chemical reactor according to claim 1, wherein the thin film heater has an electrical resistive element which heats by an applied voltage.

12. The compact chemical reactor according to  
25 claim 1, wherein

a third substrate is provided on a surface of the first substrate which is opposite to the surface

attached to the second substrate; and

another micro flow path is provided between the first substrate and the third substrate.

13. The compact chemical reactor according to  
5 claim 12, wherein

the flow path between the first substrate and the third substrate overlaps at least in part the flow path between the first substrate and the second substrate.

14. The compact chemical reactor according to  
10 claim 12, wherein

a first groove is provided in the surface of the second substrate opposite to the first substrate; and

a second groove is provided in the surface of the first substrate opposite to the third substrate.

15. The compact chemical reactor according to  
claim 12, wherein

the thin film heater is provided on the surface of the first substrate.

16. The compact chemical reactor according to  
20 claim 12, wherein

a catalyst layer is provided on the surface of the first substrate opposite to the second substrate.

17. The compact chemical reactor according to  
claim 1, wherein

25 a third substrate is provided on a surface of the first substrate which is opposite to a surface attached to the second substrate; and

a second micro flow path is provided between the first substrate and the third substrate; and

5 a combustion catalyst layer which promotes a combustion reaction of a fluid flowing in the second flow path is provided in the second flow path.

18. The compact chemical reactor according to claim 1, wherein

10 a third substrate is provided on a second surface of the first substrate which is opposite to a first surface attached to the second substrate; and

the first substrate is provided with grooves respectively formed in the first surface and the second surface.

19. The compact chemical reactor according to 15 claim 1, wherein the thin film heater generates heat to vaporize a fluid flowing in the flow path.

20. The compact chemical reactor according to claim 1, wherein

20 a catalyst layer made of a catalyst which promotes a reaction to reform a fluid flowing in the flow path into hydrogen is provided in the flow path.

21. The compact chemical reactor according to claim 1, wherein

25 a catalyst layer including a catalyst which promotes a reaction to produce carbon dioxide from carbon monoxide flowing in the flow path is provided in the flow path.

22. A chemical reaction system comprising:

(a) a reaction section which includes:

a first substrate;

a second substrate attached to the first

5 substrate;

a micro flow path defined between the first substrate and the second substrate; and

a thin film heater provided in the flow path,

wherein the reactor section reforms a fuel into 10 hydrogen in the flow path; and

(b) a power generation section which generates electricity with hydrogen produced by the reaction section.

23. The chemical reaction system according to

15 claim 22, wherein

the reaction section includes a combustion section which propagates heat from fuel combustion to the reaction section.

24. A chemical reaction system comprising:

20 (a) a reaction section which includes:

a first substrate;

a second substrate attached to the first 25 substrate;

a micro flow path defined between the first substrate and the second substrate; and

a thin film heater provided in the flow path, wherein the reactor section reforms a fuel into

hydrogen in the flow path;

(b) a power generation section which generates electricity with hydrogen produced by the reaction section; and

5 (c) a load which activates with electrical power generated by the power generation section.

25. The chemical reaction system according to claim 24, wherein the load is a computer.

10 26. The chemical reaction system according to claim 24, wherein the load is a telephone.

27. The chemical reaction system according to claim 24, wherein the load is an image pickup device.